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Level-Loading of Enlisted Accessions

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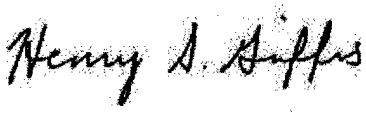

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14. ABSTRACT: Targeted enlistment bonuses in the Nuclear Field have helped achieve a more level flow of accessions into training facilities. For most ratings, the accession profile is disproportionately concentrated in the summer months. This helps the Navy aggressively recruit high school seniors, but requires a large training infrastructure to accommodate the large number of recruits in the summer. This study estimates the relationship between enlistment bonuses and the ability of the Nuclear Field to level-load accessions and calculates the cost to the Navy of level-loading other ratings.

Our analysis confirms that enlistment bonuses are effective in convincing Nuclear Field recruits to ship in off-peak months. If other recruits respond to pay in the same way, the Navy could level-load other ratings with a more aggressive application of targeted bonuses. In contrast, economic conditions have a small effect on the ability to level-load accessions.

Using bonuses to level-load accessions requires a large pool of high school seniors. Given constraints on time in the Delayed Entry Program, success depends on the number that enter the DEP relatively late in their senior years. Second, level-loading accessions will increase attrition if the Navy increases the amount of time recruits expect to spend in the DEP.

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Background

For most ratings, the Navy's accession profile is disproportionately concentrated in the summer months. This helps the Navy aggressively recruit in the market of high school seniors who graduate each spring and allows the Navy to save on personnel expenditures in the short run, delivering a given endstrength at lower cost. Allowing accessions to surge in the summer months has costs as well, the most prominent of which is sizing of the training infrastructure to accommodate the large number of recruits in the summer. In addition, seasonal variation in accessions results in seasonal variation in fleet manning, as recruits complete initial skills training and arrive in the fleet.

Since FY86, the use of targeted enlistment bonuses in the Nuclear Field has helped achieve a more level flow of accessions into training facilities. Enlistment bonuses for these recruits vary in size by the season in which a recruit agrees to ship; higher bonuses in off-peak months encourage Sailors to ship in these months, reducing the size of the summer surge.

The Director, Military Personnel Plans and Policy Division (N13) asked CNA to estimate the relationship between enlistment bonuses and the ability of the Navy to achieve a more level flow of accessions into the Nuclear Field. The efficacy of enlistment bonuses at reducing the summer surge is a critical determinant of the costs of level-loading. In addition, we quantify the role of economic conditions in the decision to ship in off-peak months, as well as their effect on attrition and recruit quality.

Methodology

Our approach involves two steps. First, we construct and estimate a model of Nuclear Field recruit behavior. We focus on the choice to ship in peak vs. off-peak months, in order to obtain estimates of the effects of enlistment bonuses and economic conditions on this decision. To measure the independent effect of these variables, we estimate models that simultaneously control for other factors that affect Sailor choice.

Second, we use these estimates to calculate the cost to the Navy of level-loading accessions in other ratings. Since any attempt to level-load other ratings is likely to be done as an experiment in a few specialties, we identify a few ratings that appear to be promising candidates for such an experiment. We then estimate two separate components of the costs of level-loading: increases in enlistment bonuses and increases in personnel costs.

Findings

Our analysis confirms that targeted enlistment bonuses are effective in convincing Nuclear Field recruits to ship in off-peak months. If accessions in other ratings respond to pay in the same way as Nuclear Field recruits, the Navy could level-load these other ratings with a more aggressive application of targeted bonuses.

The data reveal a few important considerations when trying to achieve a level-loaded accession profile. First, high school seniors are significantly more responsive to pay than workforce recruits. Consequently, using targeted bonuses to achieve a level flow of accessions requires a sufficiently large pool of high school seniors. However, ship dates are constrained by the time at which they enter the Delayed Entry Program (DEP), so the success of using targeted bonuses depends on the number that enter the DEP relatively late in their senior years.

Second, seasonal differences in attrition of Nuclear Field recruits are completely explained by differences in the amount of time spent in the DEP. Therefore, level-loading accessions will increase DEP

attrition if the Navy increases the amount of time recruits expect to spend in the DEP. Since high school seniors are most responsive to changes in enlistment bonuses, an increase in attrition seems likely. This higher attrition will increase the Navy's recruiting costs as it replaces those who attrite.

Finally, economic conditions have a very small effect on the ability to level-load accessions. For modest changes in economic conditions, it does not appear that the impact is significant enough to outweigh any benefits of level-loading; in fact, relatively small changes in bonuses could offset any deleterious effects of a strong civilian economy.

Implications and recommendations

Our focus on the Nuclear Field has both strong advantages and disadvantages. The primary benefit is a long history of seasonal variation in enlistment bonuses in the Nuclear Field. This variation allows for a more precise estimate of the effect of enlistment bonuses on the decision to ship in peak vs. off-peak months.

The most obvious disadvantage is that the Nuclear Field and its recruits are unlike any other rating or program. There is no empirical evidence to suggest that other Sailors respond to incentives in the same manner as accessions into the Nuclear Field. Consequently, it is not clear whether our estimates are larger or smaller than the behavior that would be observed if level-loading were attempted for other ratings.

Therefore, we recommend that our estimates be used as *starting points* in a level-loading experiment with other ratings outside the Nuclear Field. An actual experiment will allow the Navy to obtain more precise estimates and would help identify unforeseen difficulties in or unintended consequences of trying to level-load these ratings.

Finally, our analysis addresses only the cost of level-loading accessions; it does not attempt to quantify the benefits. Before deciding to level-load other ratings, the Navy should obtain estimates of these benefits from Naval Education and Training Command (NETC) in order to assess the potential return on investment of level-loading.

Introduction[1]

The Navy's accession profile is disproportionately concentrated in the summer months. This helps the Navy aggressively recruit in the market of high-quality, high school seniors who graduate each spring. Delaying accessions until the end of the fiscal year also allows the Navy to save on personnel expenditures in the short run, delivering a given endstrength at lower cost.

Allowing accessions to "surge" in the summer months has costs as well as benefits. Most prominent is sizing of the training infrastructure to accommodate the large number of recruits entering the Navy in the summer. This infrastructure is larger than it would be if accessions entered at a constant rate throughout the year. Furthermore, the summer surge increases the number of Sailors awaiting instruction, which raises expenditures on training. In addition, this seasonal variation in accessions results in seasonal variation in fleet manning, as recruits complete initial skills training and arrive in the fleet.

Since FY86, the use of targeted enlistment bonuses in the Nuclear Field (NF) has helped achieve a more level flow of accessions into NF training facilities.[2] Enlistment bonuses (EBs) for NF recruits vary in size by the season in which a recruit agrees to ship. Relatively higher bonuses in the fall, winter, and spring encourage Sailors to ship in these months, reducing the size of the summer surge.

Although this strategy is considered successful, would it be cost-effective in other ratings? Training costs vary significantly by rating, so

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1. We are grateful to Pat Mackin, John Warner, and Judy Fernandez for their comments and suggestions. In addition, we wish to thank Mike Evans at Commander, Navy Recruiting Command (CNRC) and CAPT Cason at Naval Education Training Command (NETC) for their feedback on an earlier draft of this memorandum.

2. For early evaluations of the Nuclear Field experience, see [1, 2, and 3].

the benefits of level-loading accessions will vary as well. Furthermore, the efficacy of EBs at reducing the summer surge is a critical determinant of the costs of level-loading. Despite the NF experience, precise estimates of the effect of these bonuses are not available.

Even if level-loading accessions is generally cost-effective, it may not *always* be cost-effective. When recruiting becomes more difficult, it is also more difficult to convince recruits to defer accession until after the summer surge. This could easily tip the balance of costs and benefits so that, when the civilian economy is strong, level-loading is not cost-effective. Furthermore, the health of the economy may affect attrition from the Navy's Delayed Entry Program and from bootcamp. DEP and bootcamp attrition reduces the number of people who enter training facilities; this reduces the ability of the Navy to effectively level-load accessions and potentially affects the quality mix of recruits.

For these reasons, the Director, Military Personnel Plans and Policy Division (N13) has asked CNA to estimate the relationship between enlistment bonuses and the ability of the Navy to achieve a more level flow of accessions. In addition, we quantify the role of economic conditions in the decision to ship in off-peak months, as well as their effect on attrition and recruit quality. We were not asked to estimate the benefits to the Navy of achieving a more level flow of accessions; N13 and Naval Education and Training Command (NETC) agreed that NETC would provide the benefits estimate.

We begin with a brief description of the Nuclear Field's monthly accession profile and targeted enlistment bonus program. Then we present our estimates of the effect of enlistment bonuses and economic conditions on the decisions of recruits. The next section examines DEP attrition, bootcamp attrition, and recruit quality in the Nuclear Field, and presents estimates of the determinants of attrition. In the last two sections, we examine the costs of level-loading accessions in other ratings, and we present conclusions.

Monthly accession profiles and targeted EBs

Monthly accession profiles in the Nuclear Field

Throughout this document, "ship date" refers to the intended ship date when entering the Delayed Entry Program. As [4] shows, a large number of NF recruits ship on *different* dates than originally intended.[3] Furthermore, some NF recruits are reclassified and ship in another rating, while others attrite from DEP before they ship. Offsetting this, however, are some recruits who enter the DEP in another rating but are reclassified and ship as entrants into the Nuclear Field.

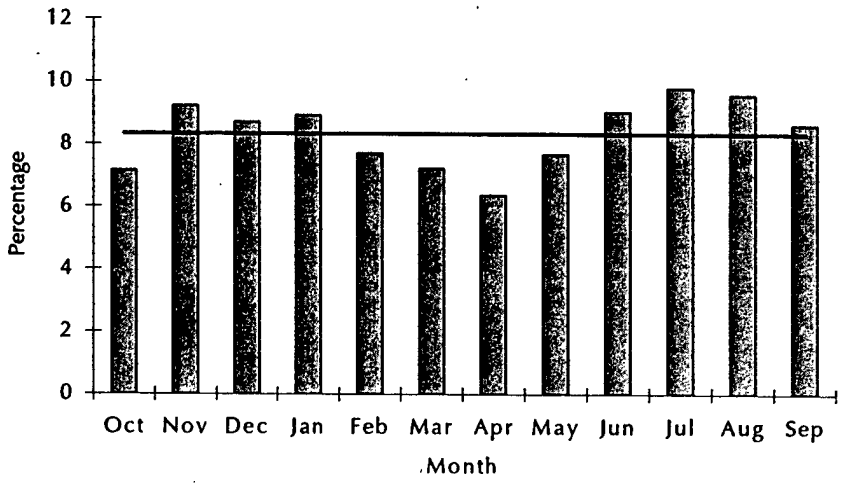
The data suggest that these two factors roughly offset each other, so that the *actual* proportion of NF recruits that ship in a given month is very close to the proportion of NF recruits that *intend* to ship in that month.[4] In other words, the Navy has been fairly successful at maintaining a flow of accessions that is close to the level expected when recruits enter the DEP. Therefore, we focus on intended ship date, since the expectation of recruits when entering the DEP is that they will actually ship on this date.[5]

Figure 1 presents the proportion of NF recruits that shipped in each month from FY86 to FY02.[6] In figure 1, the horizontal line represents

3. In particular, see figure 5 of [4].
4. For example, there is an almost perfect correlation (0.92) between the proportion of NF recruits that intend to ship during the summer and the proportion of NF recruits that actually ship during the summer.
5. Incorporating the reclassification process into our model would significantly complicate the analysis but is not likely to lead to substantively different conclusions.
6. All data summarized in this research memorandum come from CNA's holdings of PRIDE (Personalized Recruiting for Immediate and Delayed Enlistment) data.

the proportion that would be required each month for a completely level accession profile (8.3 percent). As shown, the Nuclear Field is not completely level-loaded. Accessions are lowest in February through May, when about 29 percent of all NF recruits ship.

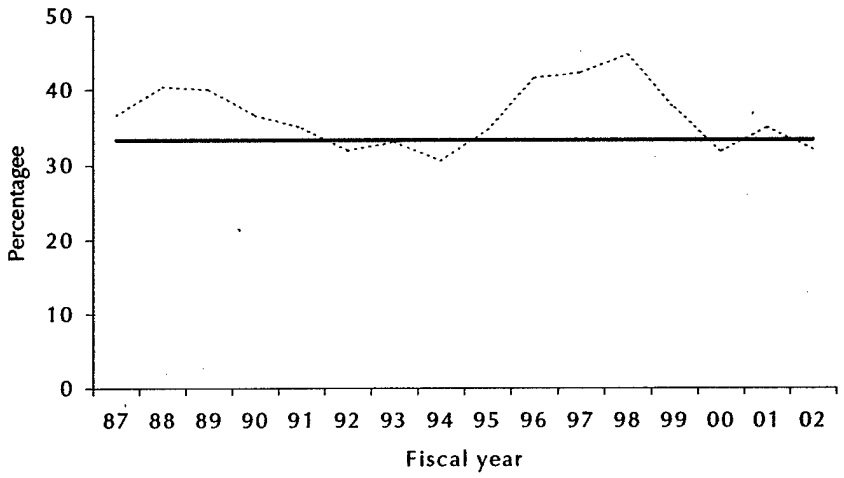
Figure 1. Monthly accession profile of NF recruits, FY86–02



In contrast, a disproportionate number of accessions enter in June through September—the summer "surge." Over the FY86–02 time period, 37 percent of NF recruits ship during these summer months. While the Nuclear Field is not fully level loaded, it does have a more level flow of accessions than other ratings, where over 47 percent of recruits ship during the summer. Consequently, the targeted enlistment bonus in the Nuclear Field is generally considered a "success" because it has resulted in a fairly level flow of accessions.

While figure 1 shows that, on average, the Nuclear Field has a fairly level accession profile, there has been notable variation over time. To illustrate this, figure 2 displays the proportion of NF recruits that ship during the June through September summer surge of each fiscal year. For comparison, the horizontal line reflects a level accession profile (i.e., one-third of all recruits ship during the four summer months). As figure 2 shows, the Nuclear Field has experienced varying degrees of success in attaining a level-loaded accession profile.

Figure 2. Proportion of NF recruits that ship in summer, FY86–02



With the beginning of the targeted enlistment bonus program in FY86, the Navy gradually reduced the summer surge of NF recruits; by FY91, the Nuclear Field had achieved a level load. During the late 1990s, however, the proportion of recruits shipping in the summer months rose dramatically. By FY98, the summer surge was greater than it had been at the beginning of the targeted bonus program. In contrast, the most recent data reflect a level accession profile.

This pattern over time is interesting because the "peaks" and "valleys" coincide with notable historical events.[7] For example, the level-load of accessions from FY92 to FY95 occurred at the same time the Navy was aggressively downsizing the number of enlisted personnel.[8] A smaller endstrength requires fewer accessions to achieve strength targets. If lower accession goals make it easier to level-load accessions,

7. The proportion of all other recruits that ship in the summer (not shown) follows a similar trend over time. This suggests that much of this trend can be traced to events other than specific NF policies.

8. As [5] discusses, the Navy used two programs—primarily from FY92 to FY95—to encourage separation, the Voluntary Separation Incentive (VSI) and the Special Separation Benefit (SSB). While the drawdown took place over a longer period of time, the aggressive use of these programs suggests that most of the downsizing occurred during this period.

the ability of the Navy to level-load the Nuclear Field during the drawdown is not surprising.

Following the most aggressive phase of the drawdown, the summer surge in the Nuclear Field began to rise dramatically through FY98; in contrast, there was little seasonal variation in the accession profile from FY00 to FY02. These changes coincided with the dramatic improvements in the civilian economy throughout the 1990s, and the subsequent recession of the past few years. In other words, economic conditions appear to play a large role in the ability of the Navy to successfully level-load its accession profile. This is not to say that Navy policies, including targeted enlistment bonuses, have no effect; rather, it points to the possibility that the civilian economy affects the success of the Navy's accession policy.[9]

Targeted enlistment bonuses in the Nuclear Field

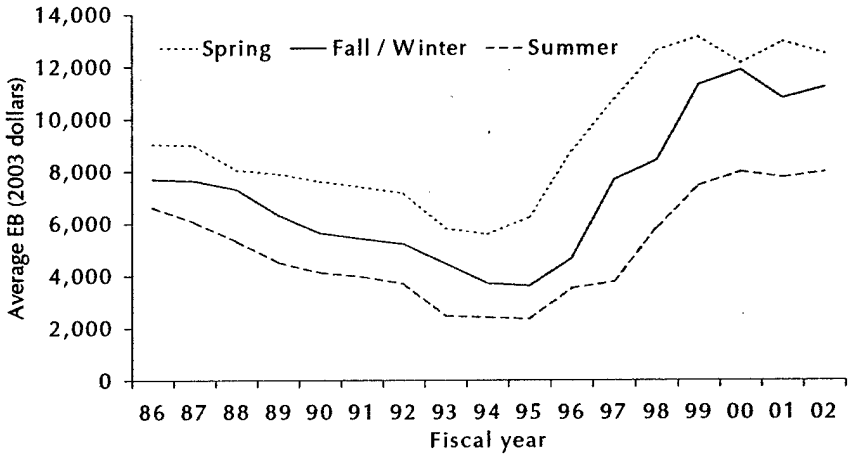
Figure 1 showed the distinct seasonal variation in Nuclear Field accessions; summer accessions are higher than average, while the preceding four months have fewer accessions than the rest of the fiscal year. Policy-makers recognize this variation and, in an attempt to level-load accessions, offer enlistment bonuses that vary by season. Figure 3 displays this seasonal variation in EBs for FY86 through FY02. For simplicity, figure 3 displays the average EB for NF recruits that ship in three different seasons: fall/winter (October, November, December, and January), spring (February, March, April, and May), and summer (June, July, August, and September). All data are adjusted for inflation and expressed in 2003 dollars.

As figure 3 shows, the seasonal variation in EBs is inversely related to the seasonal variation in accessions in figure 1. During the spring, NF

9. Relatively large military pay raises, a sagging domestic economy, and a renewed sense of patriotism have all been credited with recent increases in retention; conversely, a strong civilian economy lowers retention and makes it more difficult for the Navy to meet accession goals [6]. The inverse relationship between retention and accession requirements [7] means that a healthy economy simultaneously raises accession requirements and makes it difficult for the Navy to attract recruits.

accessions are at their lowest; in response, policy-makers have set bonuses at their highest levels for recruits who agree to ship during the spring months. In contrast, enlistment bonuses are at their lowest during the summer surge. Enlistment bonuses for ship dates in the fall/winter months are between those offered in the spring and summer.

Figure 3. Targeted EBs in the Nuclear Field, FY86–02



This seasonal pattern in enlistment bonuses has remained similar for the duration of the targeted EB program. However, figure 3 also suggests that policy-makers have adjusted the value of these bonuses over time, in response to the needs of recruiters. From FY86 to the end of the drawdown, the real value of these bonuses slowly eroded each year. By FY95, targeted EBs offered to those willing to ship in the spring were 30 percent lower (in real terms) than they were at the beginning of the program; the value of bonuses in other months fell by more than 50 percent. Since FY95, however, the value of these bonuses has increased dramatically; spring bonuses have roughly doubled, while bonuses in other months have increased by over 200 percent.

A comparison of figures 2 and 3 suggests that most of the growth in EBs after FY95 coincided with an increase in the proportion of NF

recruits shipping during the summer months. This is indeed the case; there is a positive correlation between the relative size of off-peak bonuses and the size of the summer surge. In other words, higher off-peak bonuses are associated with relatively *more* recruits shipping during the summer.

This relationship does *not* imply that bonuses have a perverse effect on a recruit's decision to ship at a certain point during the year.[10] Rather, it likely reflects the fact that policy-makers are appropriately responding to trends in the size of the summer surge, and are raising off-peak bonuses as level loading becomes more difficult. To estimate the effect of financial incentives on a person's decision to ship in peak vs. off-peak months, then, it is necessary to construct a model of individual behavior.

10. One expects that a decision to ship in a given month *increases* with the relative size of the bonus offered to ship in that month.

Enlistment bonuses, economic conditions, and individual behavior

Methodology

There is a large literature that examines the supply of enlistments and estimates models of enlistment behavior.[11] The evolution of previous research reflects an understanding that modeling the relationship between financial incentives and recruit behavior is a complex process. In fact, some researchers have concluded that the limitations of existing methods are so severe that it is not possible to obtain reliable estimates [9, 10]. Rather, they suggest that a more profitable approach would be to conduct an experiment with these incentives in order to accurately measure their effect on recruit behavior.[12]

Without the results of such an experiment, however, the Navy still needs to make policy decisions involving the allocation of financial incentives. Our approach, therefore, involves two steps. First, we construct and estimate a model of recruit behavior, acknowledging the cautions raised in the literature and attempting to address several of the complexities. Second, we recommend that our estimates be used as *starting points* in an experiment with ratings outside the Nuclear Field. An actual experiment will allow the Navy to obtain estimates that may vary from those generated by our econometric framework. Furthermore, a pilot program with a few ratings will help identify unforeseen difficulties in or unintended consequences of trying to level-load these ratings.

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11. See [8] for an excellent summary of the earlier literature; reference [9] discusses the more recent literature.

12. See [11] and [12] for discussions of previous experiments with incentives and recruiting.

Using Nuclear Field estimates for other ratings

Our focus on the Nuclear Field has both strong advantages and disadvantages. The primary benefit of this focus is a long history of seasonal variation in enlistment bonuses in the Nuclear Field; targeted EBs have been used in other ratings only recently. This variation allows for a more precise estimate of the effect of enlistment bonuses on the decision to ship in peak vs. off-peak months.

Second, the long history of level-loading in the Nuclear Field implies that there is a level-loading "mentality" among NF recruiters and recruits. As [9] notes, off–peak accessions in other ratings are more likely to attrite from the Navy than recruits that access during the summer surge. If this behavior is associated with being an accession at a "non-traditional" point in the year, it likely will not persist in a level-loading environment. In contrast, the Nuclear Field has operated in such an environment for two decades; shipping in off-peak months is not considered "abnormal."

Third, the unique nature of the Nuclear Field eliminates some of the difficulties in estimating models of enlistment behavior. Most prominent is the traditional problem of omitting the classification process [9]. The literature concludes that classifiers exert a very strong influence on a recruit's decision to enlist in a specific rating, and that most estimates of the effect of financial incentives are clouded by the unmeasured effect of classifiers. Furthermore, [8] concludes that enlistment bonuses are more effective at "channeling" people into specific occupations than they are at expanding the market of recruits. Empirically distinguishing between these effects is a challenge for most models of enlistment behavior.

As [4] discusses, however, the Nuclear Field is the only program toward which recruiters have reason to target their recruiting efforts. NF recruiters are given specific monthly recruiting goals for the Nuclear Field, providing them with a direct incentive to meet these goals. Consequently, it is in the interest of these recruiters to provide potential recruits with specific information about the Nuclear Field, including detailed information on the financial incentives available to NF enlistees, and the extent to which they vary by season.

This implies that the "channeling effect" is likely smaller in estimates of the effect of enlistment bonuses for NF recruits than for recruits in other ratings. Increases in NF enlistment bonuses likely attract some recruits who would have otherwise chosen other ratings, but relative increases in other bonuses are less likely to draw recruits away from the Nuclear Field.

For all the advantages of focusing on the Nuclear Field, the most obvious disadvantage is that it is unlike any other rating or program. There is no empirical evidence to suggest that other Sailors respond to incentives in the same way as accessions into the Nuclear Field, so it is not clear whether our estimates are larger or smaller than what would be observed if level-loading were attempted for other ratings. Furthermore, all NF recruits are "high quality" using conventional definitions of recruit quality; therefore, the population of potential recruits is very different from the target population of most other ratings. As a result, our estimates may not be accurate predictors of behavior in other ratings. Instead, they should be interpreted as "starting values" for any experiment with level-loading other ratings.

Model

Most models of enlistment behavior focus on the decision to join the military, with some focus on the decision to enter various occupations within the military [8]. Our model is quite different, in that we do *not* model the decision to enter the Navy, or even to enter the Nuclear Field. Given the relatively small "market expansion" effect of EBs and the uniqueness of the Nuclear Field discussed above, this approach is not likely to cause serious bias in our estimates. Rather, we focus on the decision to ship in peak vs. off-peak months, conditional on deciding to enter the Navy and the Nuclear Field.

Modeling the decision to ship in peak vs. off-peak months is bound by two constraints. First, all recruits must ship within 12 months of entering the Delayed Entry Program.[13] Those who choose not to ship

13. In July 2004, CNRC implemented a policy that allows those still in high school to remain in DEP for 15 months if they enlist in May, June, or July. Our data do not include recruits affected by this change in policy.

immediately, then, have a finite number of months in which to ship. Second, recruits currently in high school cannot ship until they graduate. In other words, high school seniors have even fewer options than workforce recruits.[14] Consequently, it is necessary to model the decision-making process of these two groups separately.

Given the pattern in accessions and bonuses displayed in figures 1 and 3, we model the NF recruit's decision to ship in different seasons, not different months. Therefore, workforce recruits choose to ship in one of four seasons: the current season (i.e., ship immediately) or any of the other three. For example, workforce recruits in the fall/winter can ship in the fall/winter, spring, or summer of this fiscal year, or in the fall/winter of the next fiscal year. Similarly, workforce recruits in the spring can ship in the spring or summer of this fiscal year, or in the fall/winter or spring of the next fiscal year. In contrast, high school seniors in the fall/winter can ship only in the summer of this fiscal year or in the fall/winter of the next fiscal year.

As a result, we estimate six separate models (two different types of recruits that enter the DEP in one of three different seasons), each with up to four seasons from which a recruit chooses to ship. To isolate the effect of EBs and economic conditions on this decision, we make use of the multinomial logit regression model.[15] This model is a common statistical technique to use when the behavior being studied is a choice among more than two outcomes.[16] In our models, the outcomes we examine are the choice to ship in different seasons.

In presenting our results, the effects of EBs and economic conditions are a weighted average of the effects we estimate in each of our multinomial logit models. If, for example, the proportion of recruits who

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14. Our data do not identify whether workforce recruits are employed at the time of their enlistment decision.

15. For a detailed explanation of the multinomial logit model, see [13].

16. When the behavior being studied is dichotomous (binary choice), the multinomial logit is identical to the standard logit model. As [13] discusses, the multinomial logit model is equivalent to simultaneously estimating binary choice models for all possible combinations of outcomes.

enter the DEP in each season changes over time, the actual effect of these variables can differ from our estimates.

To measure the independent effect of EBs and economic conditions on the choice to ship in different seasons, we estimate models that *simultaneously* control for other factors that affect this decision.[17] In addition to the demographic characteristics of the individual (e.g., gender, race/ethnicity, age, Armed Forces Qualification Test score), we control for factors that serve as proxies for the recruiting environment at the time a person enters the DEP. Specifically, these include the month/year of entrance to the DEP, bonuses available to enter the Advanced Electronics/Computer Field (AECF), Navy College Fund (NCF), and the number of recruiters working in the state in which a person resides.

If these variables do not completely control for recruiter behavior and seat availability in skills training, our estimates of the effect of enlistment bonuses may partially include these demand-side effects.[18] Furthermore, if increases in Nuclear Field EBs draw in recruits who would have accessed into other ratings, our estimates will be higher than the actual responsiveness of NF recruits to targeted enlistment bonuses.

Finally, if targeted enlistment bonuses are adjusted in a single rating, it is probable that it would "compete" with other ratings for the same pool of recruits. If this is the case, the number of accessions may increase in the rating with an increase in EBs at the expense of another rating. While this would improve level-loading in a single rating, it would not make the Navy more level-loaded. Consequently, our estimates are most appropriately applied to level-loading a few, disparate ratings and not the entire Navy.

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17. Complete regression results are available on request.

18. Reference [14] demonstrates that controlling for these demand-side factors increases estimates of the effect of financial incentives on enlistment supply. We observe the same relationship in our model, which indicates that we have at least partially accounted for these factors.

Results

Enlistment bonuses

The effect of off-peak enlistment bonuses on the decision to ship in the summer is negative and statistically significant; increases in these bonuses do reduce the summer surge.[19] Specifically, a 1-percent increase in off-peak bonuses leads to a 1.9-percent decrease in the proportion of NF recruits shipping during the summer.[20] For example, 37 percent of NF recruits ship during the summer months over the FY86–02 time period (figure 1). Our estimates suggest that a 5.3-percent increase in off-peak bonuses would have reduced this to 33 percent, a level-loaded accession profile. With 47 percent of non-NF recruits shipping during the summer, a 15-percent increase in off-peak bonuses would level-load these ratings.

The data in figure 3 provide information on the current bonus structure in the Nuclear Field. In FY02, bonuses for recruits who shipped during the summer months averaged about $8,000. In contrast, bonuses for shipping in the fall/winter (about $11,200) and spring (about $12,500) months were even higher. While a 1-percent increase in off-peak bonuses is fairly modest, note that fall/winter bonuses are already about 40 percent higher than summer bonuses; spring bonuses are 55 percent higher.

This relationship can be decomposed into two different effects: the responsiveness of high school seniors and workforce recruits to targeted enlistment bonuses. High school seniors are significantly more sensitive to changes in bonuses. We estimate an elasticity of -2.7 percent for seniors, compared with an elasticity of -0.1 percent for high school graduates. In other words, a 1-percent increase in off-peak

19. Reference [15] focuses on cost data of military pay and recruiter requirements, concluding that "there was insufficient mathematical data available" to examine enlistment bonuses. References [16] and [17], however, conclude that changes in EBs can improve level-loading.

20. Reference [17] estimates a significantly smaller elasticity; however, it focuses only on those who enter the DEP and ship between December 1994 and September 1997.

bonuses leads to a 2.7-percent decrease in the proportion of seniors who ship during the summer. The behavior of workforce recruits, however, is virtually unchanged.

Consequently, using targeted enlistment bonuses to achieve a level-loading of accessions requires a sufficiently large pool of high school seniors. Over the FY86–02 time period, 63 percent of all high school senior recruits into the Nuclear Field shipped during the summer. By comparison, only 15 percent of workforce recruits shipped during the summer surge. The Nuclear Field, then, achieves a fairly level flow of accessions by bringing in large numbers of high school graduates during off-peak months. At the margin, however, changes in the summer surge are most effectively achieved by convincing high school *seniors* to ship during off-peak months.

The difficulty with relying on high school seniors is that their ship dates are constrained by the time at which they enter the DEP. For example, those who enter during the summer before their senior year have no choice but to ship during the summer following their senior year.[21] Similarly, those entering the DEP during the fall/winter of their senior year cannot ship in the spring, the season with the smallest number of accessions. They cannot ship in the spring of the same fiscal year because they are still in high school; they cannot ship in the spring of the following fiscal year because that would require spending more time in the DEP than is currently allowed.

Therefore, the success of using targeted EBs to significantly reduce the size of the summer surge depends on the number of high school seniors who enter the DEP relatively late in their senior years. While earlier DEP entry might signal their interest to the Navy, it limits the flexibility of recruiters to level-load accessions.

Economic conditions

The effect of civilian unemployment rates on the decision to ship in the summer is negative and statistically significant, suggesting that

21. Even with the recent policy change, only those who enter the DEP in July before their senior year could ship after the summer following their senior year.

economic conditions do reduce the summer surge. In other words, when economic conditions are poor, NF recruits are more willing to ship in off-peak months. Specifically, a 1-percentage-point increase in the unemployment rate at the time one enters the DEP leads to a 1-percent decrease in the proportion of NF recruits shipping during the summer.[22]

This relationship between economic conditions and the Navy's ability to level-load is intuitive. When economic conditions are poor, job opportunities for potential recruits are less favorable. Consequently, recruits will be more willing to accept shipping in off-peak months. In contrast, a strong civilian labor market makes recruiting more difficult. In this environment, the Navy is likely more concerned with meeting recruiting goals than with level-loading accessions over the fiscal year.

A 1-percentage-point increase in unemployment rates is an extremely large change in economic conditions. For example, the unemployment rate in FY02 was 5.8 percent. An increase in unemployment to 6.8 percent is a *17-percent* increase. In other words, extremely large changes in economic conditions lead to relatively small changes in the size of the summer surge.[23]

An alternative explanation is that recruits from states with high regional unemployment rates are more likely to ship in off-peak months than those from states with relatively low unemployment. From a recruiting perspective, this suggests that the Navy can more successfully level-load if it focuses in recruiting environments in which civilian job opportunities are less favorable.

The effect of economic conditions can also be decomposed into different levels of responsiveness of high school seniors and workforce recruits to changes in the civilian economy. Unlike enlistment bonuses, however, it is workforce recruits who are significantly more sensitive to changes in economic conditions. We estimate an elasticity

22. Reference [16] reaches the same qualitative conclusion.

23. Reference [18] reaches a similar conclusion about the effect of economic conditions on the probability that a person chooses to enlist.

of -2.0 percent for graduates, compared with an elasticity of -0.6 percent for high school seniors. In other words, a 1-percentage-point increase in the unemployment rate leads to a 2-percent decrease in the proportion of workforce recruits that ship during the summer. In contrast, the behavior of high school seniors is relatively insensitive to changes in economic conditions.

These differences in behavior are intuitive. Workforce recruits are, by definition, currently in the labor market at the time they enter the DEP, and are therefore more likely to be influenced by the current state of the labor market. In contrast, economic conditions have less of an effect on seniors while they are in school. Rather, it is likely that individual expectations about *future* conditions affect the behavior of current high school seniors.

In response to improvements in the civilian economy, our results suggest that the Navy can use targeted enlistment bonuses to maintain a level flow of accessions. For example, a 1-percentage-point decrease in the unemployment rate can be offset with a half-percent increase in off-peak bonuses. This would change the mix of recruits entering during off-peak months, with a decrease in the number of workforce recruits and an increase in the number of high school seniors.

Level-loading, attrition, and recruit quality

Our results demonstrate that targeted enlistment bonuses are successful at reducing the seasonal variation in accessions and convincing recruits to ship in off-peak months. Furthermore, the health of the economy plays a minor role in the ability of the Navy to level-load accessions. However, these factors may also influence attrition. Attrition reduces the number of people who ship in a given season and who enter skills training. In other words, while the Navy can plan a level-load of accessions by convincing recruits to select different shipping dates, attrition can alter the mix of recruits that *actually* ship at different points during the year. In addition, attrition potentially affects the quality mix of recruits. Changes in both attrition and recruit quality will affect the Navy's recruiting costs.

Attrition

We examine two different measures of attrition. Attrition from the Delayed Entry Program reduces the number of recruits that ship in a given season. Attrition from bootcamp reduces the number of recruits that ship and actually enter skills training. Since a major goal of level-loading is to reduce the training infrastructure, the most relevant measure of attrition is probably the combination of DEP and bootcamp attrition. This metric reflects the proportion of planned accessions that actually enter skills training. Some of the factors on which we focus affect DEP and bootcamp attrition in different ways, however, so we examine each of these components separately before measuring their effect on total attrition.

DEP attrition

Figure 4 displays DEP attrition rates of NF recruits, calculated separately for each fiscal year. On average, 15.6 percent of all NF recruits attrite before reaching bootcamp. There is, however, notable variation over FY86 through FY02. Attrition rose throughout the 1980s,

reaching a high in FY92. During the drawdown, attrition rates fell; from FY96 to FY00, however, attrition rose each year until it reached pre-drawdown levels. In recent years, attrition rates have fallen.

Figure 4. DEP attrition rate in the Nuclear Field, FY86–02

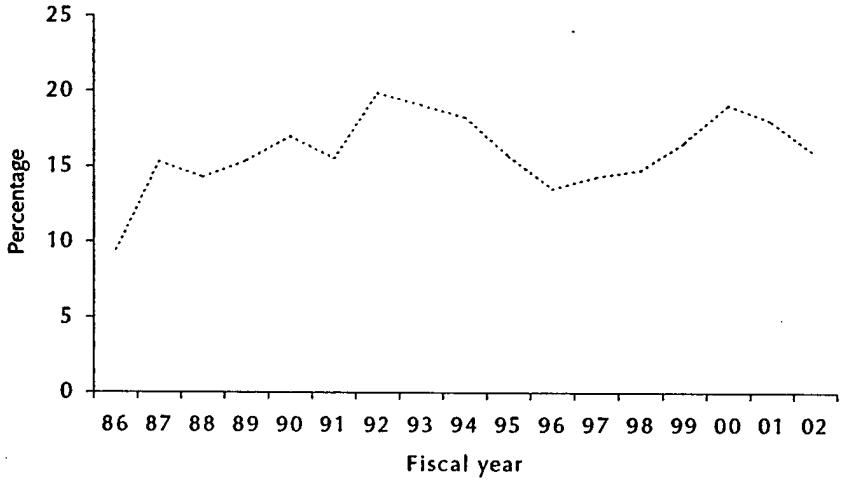


Table 1 lists DEP attrition rates, calculated separately for those who ship in each season. As table 1 shows, DEP attrition is highest for those who ship in the summer and lowest for those who ship in the spring. That is, a more level-loaded accession profile (i.e., a smaller summer surge) is accompanied by *lower* DEP attrition. In the Nuclear Field, reducing the summer surge from 37 percent (figure 1) to a level-loaded profile lowers the DEP attrition rate from 15.6 percent to 15.3 percent. In other words, a reduction in the summer surge by 10 percent reduces DEP attrition by about 1.5 percent.

Table 1. DEP attrition rates by ship date, FY86–02

Season	Attrition rate
Fall/winter	14.6
Spring	12.7
Summer	18.8

The reason for this relationship is that summer accessions spend a longer amount of time in the Delayed Entry Program; furthermore, time spent in the DEP is positively correlated with DEP attrition. Over the FY86–02 period, those who actually ship spend about 6 months in the DEP. In contrast, those who attrite have about 8 months between the time they enter the DEP and the time they are supposed to enter bootcamp.[24] Indeed, once we adjust for time spent in the DEP, there is no difference in attrition rates for recruits by ship date.

The effect of level-loading accessions on DEP attrition, then, depends on how the Navy reduces the seasonal flow of recruits into bootcamp. If reductions in summer accessions are achieved by convincing people to delay their ship dates until the next fiscal year, DEP attrition will rise. Since high school seniors are most responsive to changes in enlistment bonuses, this is the likely outcome. In contrast, convincing people to ship before the summer will reduce DEP attrition.

Bootcamp attrition

Figure 5 displays bootcamp attrition rates of NF recruits, calculated separately for each fiscal year. These are *conditional* attrition rates; that is, they are only calculated for recruits who do not attrite from DEP. On average, 6.2 percent of all NF accessions attrite before completing bootcamp. The most notable deviations from this average occur during FY97 and FY98, when 9.2 and 11.1 percent of accessions, respectively, attrited from bootcamp.

It is interesting to note that FY97 and FY98 had the highest proportion of accessions entering during the summer surge (figure 2). As table 2 shows, however, summer accessions actually have slightly *lower* bootcamp attrition than other NF recruits. In contrast, spring accessions have the highest attrition rates from bootcamp. This seasonal pattern is the exact opposite of that for DEP attrition (table 1).

Time spent in the DEP is positively correlated with DEP attrition but *negatively* correlated with bootcamp attrition. Over the FY86–02 time

24. Since these recruits, by definition, attrite before entering bootcamp, we calculate the length of time they are supposed to remain in DEP, not the length of time they actually do so.

period, recruits who do not attrite from bootcamp spend about 6.2 months in the DEP. In contrast, those who attrite spend about 5.6 months in the DEP. Once we adjust for the length of time spent in DEP, there is no difference in bootcamp attrition rates by season.

Figure 5. Bootcamp attrition rate in the Nuclear Field, FY86–02

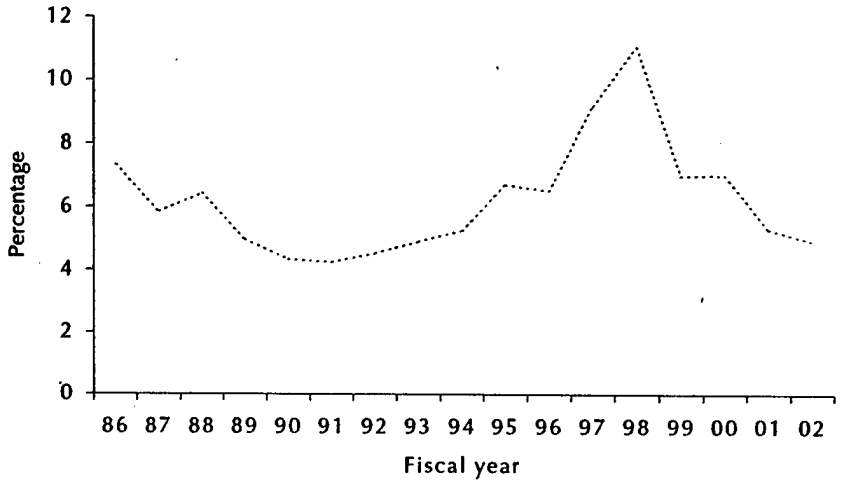


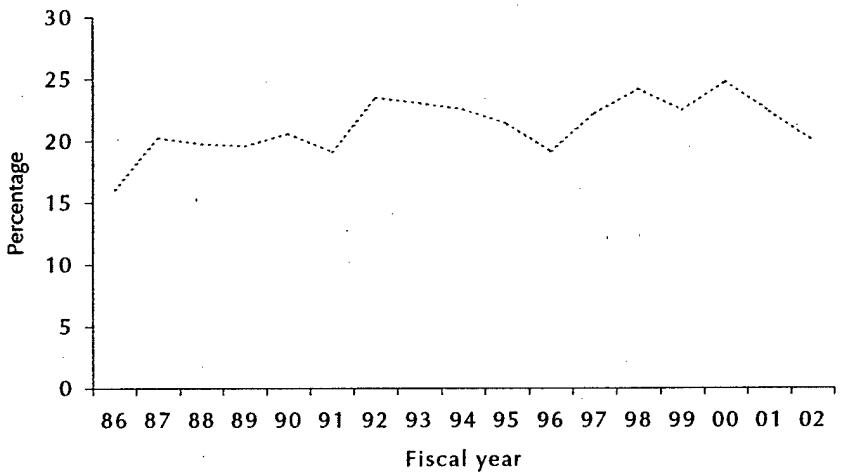
Table 2. Bootcamp attrition rates by ship date, FY86–02

Season	Attrition rate
Fall/winter	6.1
Spring	6.6
Summer	5.8

Total attrition

Figure 6 combines the DEP and bootcamp attrition data into a total attrition rate, calculated separately for each fiscal year. In figure 6, a recruit is considered an attrite if he or she attrites either from the DEP *or* from bootcamp. As figure 6 shows, the variation over time in total attrition closely follows the trend in DEP attrition (figure 4). Attrition ranges from a low of 16 percent in FY86 to a high of almost 25 percent in FY00.

Figure 6. DEP and bootcamp attrition in the Nuclear Field, FY86–02



Furthermore, low bootcamp attrition implies that the seasonal variation in DEP attrition dominates. As table 3 shows, those shipping in the summer have the highest attrition rates; those shipping in the spring have the lowest. Once again, however, these seasonal differences are completely accounted for by amount of time spent in the Delayed Entry Program.

Table 3. Total attrition rates by ship date, FY86–02

Season	Attrition rate
Fall/winter	19.8
Spring	18.5
Summer	23.5

Recruit quality

Recruit "quality" is typically characterized by a combination of a person's educational attainment and performance on the Armed Forces Qualification Test (AFQT). For example, those who have completed high school and score at or above the 50th percentile on the AFQT are considered "high-quality" recruits [6]. They are considered to be

high-quality recruits because they are the least likely to attrite from bootcamp or the fleet.

For Nuclear Field recruits, this definition of quality is less useful. In FY03, for example, 99.5 percent of all NF recruits had completed high school; every NF recruit scored at or above the 50th percentile on the AFQT. In other words, *all* NF recruits are "high-quality" under the conventional definition.

To examine the relationship between level-loading and NF recruit quality, then, it is necessary to use a different definition of quality. This difference must be kept in mind when extending these results to the general population of Navy recruits. Furthermore, we must stress that the lowest quality NF recruits are *not* "low-quality"; if they were in any other rating, they would be considered high-quality recruits.

Figure 7 displays the proportion of NF recruits that scored at or above the 90th percentile on the AFQT, calculated separately for each fiscal year.[25] The higher the proportion of recruits with AFQT scores >= 90, the higher the quality. As figure 7 shows, NF recruit quality has risen significantly over this time period. In FY86, only 37 percent had AFQT scores at or above the 90th percentile; by FY02, this had risen to over 58 percent.

Table 4 lists the proportion of recruits with AFQT scores at or above the 90th percentile, calculated separately for those who ship in each season. As table 4 shows, the highest-quality recruits ship in the spring, while the fewest high-quality recruits ship in the summer. In other words, a more level-loaded accession profile *increases* recruit quality, since high-quality recruits are more likely to ship in off-peak months.[26] Seasonal differences in recruit quality by ship date persist even when controlling for all other observable characteristics, although the differences are smaller.

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25. This is only one of several metrics that one can use to describe the quality of NF recruits; different metrics, however, yield similar qualitative conclusions.

26. Thirty-three percent of recruits with AFQT scores >= 90 ship during the summer, compared with 41 percent of other NF recruits.

Figure 7. Proportion of NF recruits with AFQT scores >= 90, FY86–02

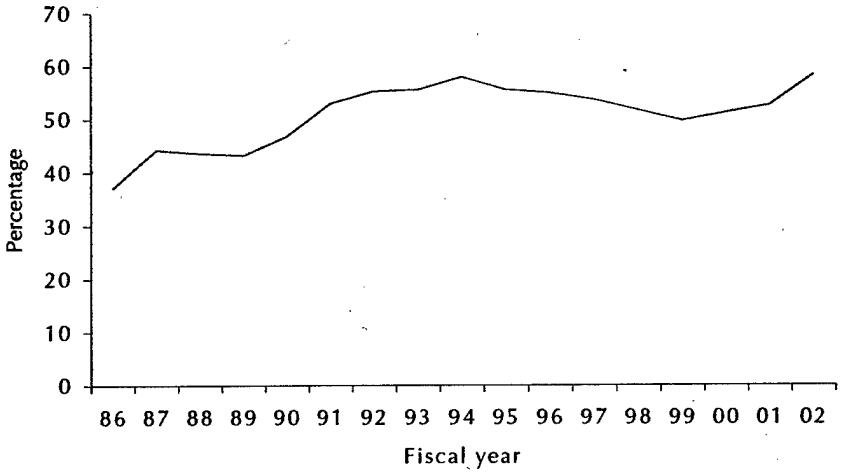

Table 4. Proportion with AFQT scores >= 90 by ship date, FY86–02

Season	Proportion high-quality
Fall/winter	50.2
Spring	55.1
Summer	43.2

Table 4 implies that reducing the summer surge from 37 to 33 percent would raise the proportion with AFQT scores >= 90 only slightly from 49 to 49.5 percent. However, if level-loading is achieved through a reallocation of existing recruits over the fiscal year, recruit quality would not change at all. In other words, recruits' AFQT scores do not change because they decide to ship in a different season. Rather, the data indicate that the highest-quality NF recruits have historically shipped in off-peak months.

Determinants of attrition

To fully investigate the effect of different characteristics and conditions on attrition, we make use of a standard logit regression model.

With this model, the choices are to "attrite" or "not attrite." As in the previous section, we estimate models that *simultaneously* control for other factors that affect this decision. However, we do estimate separate models for high school seniors and workforce recruits, given the differences in responsiveness to economic conditions and targeted enlistment bonuses. In addition, we present separate effects of these characteristics on DEP, bootcamp, and total attrition when these differences are significant.

Enlistment bonuses

It's surprising that our models indicate a small, *positive* relationship between enlistment bonuses and attrition. This relationship exists between EBs and both DEP and bootcamp attrition. This is surprising because Sailors do not receive their bonuses if they attrite at these points. Consequently, one would expect that larger bonuses make it *less* likely that one would attrite.

While this positive relationship is statistically significant, the magnitude of this effect is negligible. For example, we estimate that a 1-percent increase in EBs would increase total attrition by only 0.1 percent. This extremely small relationship exists for both high school seniors and workforce recruits, and at both the DEP and bootcamp attrition points. As a result, we conclude that EBs do not have a substantive effect on attrition.

The implication for level-loading accessions is fairly positive. Targeted EBs are effective at convincing high school seniors to ship in off-peak months, without any deleterious effects on attrition. Unfortunately, policy-makers might expect a secondary *benefit* of targeted enlistment bonuses, a reduction in DEP and bootcamp attrition. The data do not support this expectation.

Economic conditions

Unlike EBs, we do find that economic conditions play a significant role in the decision to attrite from DEP. Specifically, a deterioration of the civilian economy between the time a recruit enters the DEP and the time he or she enters bootcamp lowers DEP attrition. This relationship is consistent with expectations: a worse economy lowers

job prospects for people outside the Navy, making it less likely that recruits will leave the DEP and pursue a civilian career.

This relationship is most significant for workforce recruits. Specifically, we estimate that a 1-percentage-point increase in the unemployment rate at the time one enters bootcamp reduces DEP attrition by 6.7 percent. This elasticity is measured holding constant the unemployment rate at the time one enters DEP. In other words, changes in economic conditions have an extremely large impact on the DEP attrition of workforce recruits.

In contrast, high school seniors are not sensitive to changes in economic conditions. This is consistent with the small impact of the civilian economy on their willingness to ship in off-peak months. Other factors appear to be more important determinants of the decisions of high school seniors.

Clearly, then, economic conditions play a role in the effectiveness of level-loading accessions. When economic conditions are poor, the Navy is fairly successful at convincing workforce recruits to ship in off-peak months. Furthermore, a deteriorating civilian economy reduces attrition from the Delayed Entry Program. However, the reverse is also true: a strong civilian economy makes it more difficult to level-load accessions and contributes to higher DEP attrition.

This implies that the health of the civilian economy plays a role in the cost-effectiveness of level-loading accessions. When the economy is strong, higher enlistment bonuses would be needed to offset the pull of the civilian labor market; furthermore, DEP attrition reduces the efficacy of the level-loading strategy. Both of these factors raise the costs of level-loading.

Time spent in the DEP

As we have discussed, time spent in the DEP is positively correlated with DEP attrition but negatively correlated with bootcamp attrition. The net effect is a positive relationship between time spent in the DEP and total attrition. In other words, the longer a person expects to spend in the DEP, the more likely he or she is to attrite before entering skills training.

Table 5 displays predicted total attrition rates, calculated separately by the number of months a person expects to spend in the DEP. These predictions are estimated holding all other characteristics constant.[27] Again, it is important to emphasize that these are not *actual* months spent in the DEP; those who attrite before reaching bootcamp spend fewer months in the DEP than anticipated.

Table 5. Predicted attrition rates by time spent in the DEP

Number of months in DEP	Attrition rate
0	11.1
1	14.7
2	15.5
3	16.7
4	18.3
5	18.9
6	19.2
7	20.6
8	22.0
9	23.0
10	25.5
11	27.1
12	30.0

As table 5 shows, attrition rates vary significantly by the amount of time a recruit is scheduled to spend in the DEP. At one extreme, those who ship directly to bootcamp (i.e., 0 months in DEP) have attrition rates around 11 percent. It is intuitive that direct shippers would have the lowest attrition rates since no time in DEP removes the possibility of attriting from the DEP. As the time in DEP increases, however, there is a monotonic increase in attrition. At the other extreme, those

27. The relationship between number of months in DEP and actual attrition rates is very similar to the data presented in table 5. We estimate similar relationships between time in DEP and attrition for both high school seniors and workforce recruits.

who spend 1 year in the DEP (the maximum amount of time allowed) have attrition rates around 30 percent.

Clearly, then, the manner in which the Navy chooses to level-load accessions will have an impact on attrition. For example, if the Navy reduces summer accessions by convincing recruits to ship in the next fiscal year, attrition rates will rise since the mechanism by which accessions are delayed is to increase time spent in the DEP. On the other hand, if the Navy reduces summer accessions by convincing people to ship earlier in the same fiscal year, attrition rates will fall.

While the differences in table 5 are large, moving the Nuclear Field to a level-loaded accession profile would result in only modest changes in attrition rates. Over the FY86–02 period, NF recruits had a 20.8-percent attrition rate. Level-loading accessions by convincing high school seniors to ship after the summer would raise attrition to 21.0 percent. Alternatively, level-loading accessions by convincing workforce recruits to ship before the summer would lower attrition to 20.6 percent. The Nuclear Field is already close to level-loaded, so reducing the summer surge would involve relatively few recruits changing the date they are scheduled to ship. For ratings with a larger summer surge, differences in attrition would likely be larger.

Recruit quality

Table 6 displays predicted attrition rates for four different groups of AFQT scores. For clarity, we have separated recruits into those with scores less than 80, 80 to 89, 90 to 94, and 95 to 100. As table 6 shows, higher quality recruits (i.e., those with higher AFQT scores) have higher attrition. Those with the lowest and the highest scores have attrition rates around 18 and 23 percent, respectively.

Table 6. Predicted attrition rates by AFQT score

AFQT scores	Attrition rate
< 80	18.3
80 to 89	20.1
90 to 94	21.7
95 to 100	22.3

However, these differences in attrition are not substantial enough to significantly alter the quality mix of NF accessions. For example, 49 percent of those entering DEP have AFQT scores of 90 or above; using the results from our attrition model, we estimate that these recruits represent 48.3 percent of those who enter skills training.[28]

Summary

Our model of attrition suggests that level-loading accessions has, at most, a very modest effect on attrition and recruit quality. There are seasonal differences in attrition, but these are completely explained by changes in the amount time spent in the DEP, not by seasonal cohort effects or inherent differences in the type of recruit that ships in off-peak months. If the Navy reduces summer accessions by convincing people to ship in the following fiscal year, attrition rates will rise. The total impact on attrition rates depends on the number of people the Navy convinces to extend their time spent in the DEP, as well as the length of additional time spent in the DEP.

Higher-quality recruits are more likely to ship in off-peak months but also more likely to attrite from the DEP. If level-loading were achieved through a reallocation of existing recruits over the fiscal year, recruit quality would not change at all. If recruit quality does rise, however, differences in attrition rates offset this increase, so the quality mix of recruits entering skills training is virtually unchanged.[29]

Therefore, changes in attrition and NF recruit quality are not significant enough to affect the cost-effectiveness of level-loading accessions. These costs and benefits can be evaluated without considering the secondary effects that such a policy might have on attrition or on the quality mix of recruits. Without direct evidence of the effect of level-loading accessions on attrition and recruit quality in ratings outside the Nuclear Field, however, we recommend extreme caution in generalizing these results to other ratings.

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28. In fact, average AFQT scores of all NF recruits (88.1) and those who do not attrite (88.0) are virtually identical.

29. Reference [3] found no significant change in recruit quality during the early years of the targeted enlistment bonus program.

The cost of level-loading accessions in other ratings

Using our estimates, we can calculate the cost to the Navy of level-loading accessions in other ratings. The critical assumption is that Sailors entering these other ratings respond to financial incentives in the same way as entrants into the Nuclear Field. If these Sailors are more responsive to changes in enlistment bonuses, the cost of level-loading accessions in these ratings will be lower than our estimates.[30] Conversely, a lower responsiveness to pay will result in higher costs than we have estimated.

Since any attempt to level-load other ratings is likely to be done as an experiment in a few specialties, we first identify a few ratings that appear to be promising candidates for such an experiment. Following this discussion, we estimate the cost of level-loading accessions in these ratings. For clarity, we separate these costs into (1) increases in enlistment bonuses and (2) increases in personnel costs.

Identification of candidate ratings

One of the potential benefits of level-loading accessions is a reduction in the size of the training infrastructure. Currently, this infrastructure is sized to accommodate the summer surge; consequently, it is larger than it would need to be if accessions entered at a constant rate throughout the year. Therefore, the ratings for which we expect the biggest savings are those with the largest training infrastructures.

Although we do not have estimates of this savings, we can identify a few ratings in which the *potential* for savings is large. If the length of a

30. A high responsiveness to pay means that small changes in EBs generate large changes in the behavior of recruits. If this were the case, the Navy could level-load ratings with relatively small increases in EBs.

rating's training pipeline is correlated with the costs associated with its training infrastructure, ratings with the longest training pipelines will be those with the largest benefits from level-loading accessions.

Reference [6] provides estimates of the amount of time Sailors spend in training for a particular specialty (see appendix A of [6]). The amount of training required in different ratings varies considerably, which is not surprising. Excluding the Nuclear Field, we identify six ratings/programs with the longest training pipelines: Cryptologic Technician–Interpreter/Linguist (CTI), the Advanced Electronics/Computer Field (AECF), the Submarine Electronics/Computer Field (SECF), Missile Technician (MT), and Cryptologic Technician–Maintenance (CTM). Sailors in each of these ratings/programs spend over a year in initial skills training.

Table 7 displays, for each of these ratings, the size of the summer surge in FY03. For comparison, we also display the proportion of all non-NF recruits that ship during the summer. Table 7 reveals two notable facts. First, there is a great deal of variation in the size of the summer surge in these ratings. For example, the AECF and CTI ratings bring in about 38 percent of all accessions during the summer, while 58 percent of MTs enter in these months. Second, with the exception of MTs, each rating has a smaller-than-average summer surge. While none of these ratings is level-loaded, the data are consistent with an attempt by the Navy to level-load these ratings already.[31]

Table 7. Proportion of FY03 recruits that ship in summer—ratings with long training pipelines

Rating/program	Proportion
AECF	38.2
CTI	37.6
CTM	48.0
MT	58.1
SECF	50.3
All non-NF ratings	50.9

31. Even without an explicit policy to level-load these ratings, a smaller summer surge in these ratings allows the Navy to maintain a smaller training infrastructure.

As an alternative to the list of ratings in table 7, the Naval Education Training Command (NETC) and Naval Personnel Development Command (NPDC) have identified five ratings as promising candidates for a level-loading experiment: Aviation Structural Mechanic (AM), Aviation Ordnanceman (AO), Culinary Specialist (CS), Information System Technician (IT), and Operations Specialist (OS).[32]

The advantage of focusing on these ratings is twofold. First, these are the ratings in which the training establishment has identified considerable strain on the current level of resources. If a level-loaded accession profile reduces this strain, the Navy would likely realize tangible benefits from this reduction. Second, this list of ratings was compiled with the "competition" aspect of changes in EBs in mind. If enlistment bonuses are adjusted in a single rating, the number of accessions may increase in that rating at the expense of another. NETC and NPDC have attempted to minimize this competition between specialties in their selection of ratings for a level-loading experiment.

Table 8 displays, for each of these ratings, the size of the summer surge in FY03. For comparison, we also display the proportion of all non-NF recruits that ship during the summer. The AM, AO, and OS ratings all have a larger-than-average summer surge. In contrast, the proportion of IT accessions is slightly below average; the CS rating is the closest to being level-loaded (39 percent of these accessions enter during the summer).

Table 8. Proportion of FY03 recruits that ship in summer—NETC/NPDC ratings

Rating/program	Proportion
AM	55.3
AO	53.6
CS	39.3
IT	45.6
OS	53.3
All non-NF ratings	50.9

32. We are grateful to CAPT Cason at NETC for providing this information.

An examination of the ratings in tables 7 and 8 reveals that three of these ratings—AM, MT, and OS—have a larger-than-average summer surge and a relatively large variation in the number of recruits in its training pipeline over the fiscal year. A large summer surge combined with a comparable surge in the training pipeline implies that these ratings are delivering Sailors to the fleet with a large degree of seasonal variation.[33] Therefore, these ratings appear to be prime candidates for a level-loading experiment.

However, we emphasize that the ratings with which the Navy experiments should be those with a potentially high return on investment of level-loading. To maximize the expected benefits of such an experiment, an evaluation of both the potential costs *and* benefits of level-loading should precede the experiment. Without data on the benefits of level-loading, then, the ratings in tables 7 and 8 may or may not be ideal candidates.

Enlistment bonuses

Using our estimates of the responsiveness to targeted enlistment bonuses in the Nuclear Field, we can estimate the increase in bonus expenditures necessary to level-load the ratings/programs listed in tables 7 and 8. For each rating, we calculate these expenditures using both the current and level-loaded accession plans.

In each calculation, we use the actual number of FY03 accessions into these ratings. In addition, we assume that each accession receives the average bonus offered during the season in which that person agrees to ship. This approach overestimates the actual amount spent on enlistment bonuses since those who attrite from initial skills training do not receive the bonus expected when entering DEP. However, the difference between bonus expenditures using the current and level-loaded accession plans is likely to be a reliable estimate of the increase in actual expenditures.

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33. There is a negative correlation between the length of a rating's training pipeline and the variation in the number of recruits in the pipeline over the fiscal year. This suggests that ratings with long pipelines are able to "smooth out" some of the seasonal variation in accessions.

Enlistment bonuses will be higher when accessions are level-loaded for two reasons. First, our methodology presumes that off-peak bonuses must be raised to convince people to ship in the fall/winter or spring. Higher bonuses will lead to higher bonus expenditures, even if they are unsuccessful at reducing the summer surge. Second, however, our model predicts that some will choose to ship in off-peak months instead of during the summer. This shifts accessions from shipping in months with relatively low bonuses to months with relatively high bonuses, further increasing expenditures.

Table 9 displays these estimates for each of the ratings/programs on which we focus, as well as estimates for all non-NF ratings. In addition, table 9 lists the percentage change in bonus expenditures associated with moving to a level-loaded accession profile.

Table 9. Enlistment bonus expenditures with different accession profiles ($M)

Rating/ program	Number of accessions	Current EB expenditures	Level-loaded EB expenditures	Percentage difference
Ratings with long training pipelines				
AECF	990	4.9	5.2	7.1
CTI	175	1.4	1.5	10.3
CTM	179	0.4	0.6	49.7
MT	138	0.6	0.8	31.4
SECF	794	3.3	3.9	20.0
NETC/NPDC ratings				
AM	918	3.0	3.5	17.7
AO	980	1.7	2.6	54.5
CS	1,301	4.8	5.1	5.3
IT	677	0.6	0.7	25.3
OS	828	1.0	1.1	10.3
All non-NF ratings	37,644	78.1	91.4	17.1

As table 9 shows, larger bonus expenditures are necessary to level-load each of the ratings on which we focus. For example, our analysis predicts that raising off-peak bonuses in the AECF by 6.8 percent would level-load this program; this raises bonus expenditures on

accessions into this program by 7.1 percent. In contrast, level-loading the MT rating would require a 22.4-percent increase in off-peak bonuses; as a result, we predict that bonus expenditures on accessions into this rating would rise by 31.4 percent.[34]

Note that level-loading all non-NF ratings would result in seasonal differences in enlistment bonuses that are quite similar to those in the Nuclear Field. In FY03, for example, off-peak bonuses in the Nuclear Field were 45.5 percent higher than those offered in the summer. Our analysis implies that the Navy could level-load non-NF ratings by setting their off-peak bonuses 46.5 percent higher than those offered in the summer months.[35] This is an average across all non-NF ratings, so some ratings will have greater seasonal variation, and others will have less. However, it serves as a useful benchmark for policy-makers in adjusting enlistment bonuses to level-load accessions.

Personnel costs

Finally, we estimate the first-year personnel costs of accessions in these ratings, using both the current and level-loaded accession plans. These personnel costs include basic pay, Basic Allowances for Housing (BAH) and Subsistence (BAS), and set-asides for retirement [6].[36] In general, we expect these costs to be higher if accessions are level-loaded since more accessions enter earlier in the fiscal year. According to [15], these costs are the "most significant...factor" in the decision to level-load accessions.

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34. The CTM rating has one of the largest percentage increases in bonus expenditures, despite having a smaller-than-average summer surge. The reason is that summer accessions into this rating currently receive no enlistment bonus. Increasing off-peak bonuses, then, shifts accessions from months without a bonus into months with relatively large bonuses. The AO rating has a similar situation, with enlistment bonuses only offered to some summer accessions.

35. Off-peak bonuses in non-NF ratings are currently about 24 percent higher than summer bonuses in these ratings.

36. Following [19], we assume automatic promotion at 9 months from E-1 to E-2. We use continuation rates of FY03 accessions to model the extent to which new accessions attrite during the fiscal year.

Table 10 displays these estimates for each of the ratings/programs on which we focus, as well as estimates for all non-NF ratings. For clarity, table 10 also lists the percentage change in personnel costs associated with moving to a level-loaded accession profile.

Table 10. Personnel costs of different accession profiles ($M)

Rating/program	Number of accessions	Current personnel costs	Level-loaded personnel costs	Percentage difference
Ratings with long training pipelines				
AECF	990	13.9	14.0	0.3
CTI	175	2.6	2.5	-2.8
CTM	179	2.1	2.5	21.3
MT	138	1.6	2.0	26.0
SECF	794	10.1	11.3	12.0
NETC/NPDC ratings				
AM	918	9.9	13.0	31.4
AO	980	10.8	13.9	29.1
CS	1,301	17.1	18.4	7.6
IT	677	8.7	9.6	10.2
OS	828	9.6	11.7	22.3
All non-NF ratings	37,644	464.2	540.1	16.5

A comparison of tables 7 and 8 with table 10 confirms that, in general, the larger the summer surge, the greater the increase in personnel costs of a level-loaded accession profile. For example, only 38 percent of AECF accessions enter during the summer; moving to a level-loaded profile raises personnel costs by less than 1 percent. In contrast, the summer surge of MTs is about 58 percent; level-loading this rating would increase personnel costs by about 24 percent.

An exception is the CTM rating, with a below-average summer surge (48 percent) and above-average increases in personnel costs (19.4 percent). Unlike most ratings, more CTMs currently enter during the spring (28 percent) than during the fall/winter (24 percent). Consequently, level-loading this rating requires shifting a disproportionate number of accessions from the summer to the fall/winter months, dramatically increasing personnel costs.

In addition, table 10 reveals that level-loading the CTI rating would *reduce* personnel costs, even though the summer surge (37.6 percent) is larger than it would be with a level flow of accessions. The reason for the decrease is that more people in this rating enter during the fall/winter than in any other season. Consequently, level-loading this rating requires shifting accessions from both the summer *and* the fall/winter into the spring months. This latter reallocation of accessions brings down personnel costs.

While these costs are not trivial, we emphasize that level-loading speeds up the arrival of Sailors to the fleet [19]. In other words, the sooner a recruit accesses into the Navy, the sooner he or she can be delivered to the fleet. Therefore, the Navy is buying an increase in productivity with this increase in personnel costs. Although this is a benefit of a level-loaded accession profile, its value to the Navy is not expressed in dollars but in terms of an increase in readiness.

Summary

In summary, table 11 lists the increase in expenditures the Navy can expect to incur if it level-loads the ratings/programs listed in tables 7 and 8. At one extreme, the AECF and CTI ratings are currently close to a level-loaded accession profile; consequently, table 11 indicates a modest 2-percent increase in expenditures. In contrast, the AM, AO, CTM, and MT ratings would require more than a 25-percent increase in expenditures to attain a level-loaded accession profile. Finally, the SECF is closer to the average for all non-NF ratings, with a 14-percent increase in expenditures necessary to level-load this program.

We reemphasize that these are estimates based on the responsiveness to pay in the Nuclear Field. If the behavioral response of other accessions differs from that of Sailors entering the Nuclear Field, actual changes in expenditures will differ. Experimenting with level-loading accessions in a few ratings, however, will allow the Navy to obtain more precise estimates of responsiveness to pay in these ratings and help refine projections for the future.

Table 11. Increase in expenditures with a level-loaded accession profile ($K)

Rating/program	Increase in EB expenditures	Increase in personnel costs	Total increase in expenditures	Percentage increase
Ratings with long training pipelines				
AECF	342.9	43.3	386.2	2.1
CTI	140.9	-72.3	68.6	1.8
CTM	206.6	445.2	651.8	26.0
MT	182.7	402.9	585.6	27.4
SECF	652.1	1,206.1	1,858.2	14.0
NETC/NPDC ratings				
AM	527.6	3,104.8	3,632.4	28.2
AO	919.8	3,131.8	4,051.6	32.6
CS	256.1	1,302.3	1,558.4	7.1
IT	145.9	889.1	1,035.0	11.2
OS	99.5	2,139.4	2,238.9	21.2
All non-NF ratings	13,335.3	76,620.9	89,956.2	16.6

Conclusion

Our analysis confirms that targeted enlistment bonuses are effective in convincing Nuclear Field recruits to ship in off-peak months. If accessions in other ratings respond to pay in the same way as NF recruits, the Navy could level-load these other ratings with a more aggressive application of targeted EBs. While this research memorandum presents estimates of the cost of level-loading other ratings, it will be important to compare these costs with the benefits of level-loading accessions.

The data reveal a few important considerations when trying to achieve a level-loaded accession profile. First, high school seniors are significantly more responsive to pay than workforce recruits. Consequently, using targeted EBs to achieve a level flow of accessions requires a sufficiently large pool of high school seniors. The difficulty with relying on high school seniors, however, is that their ship dates are constrained by the time at which they enter the Delayed Entry Program. Therefore, the success of using targeted EBs to significantly reduce the size of the summer surge depends on the number of high school seniors that enter the DEP relatively late in their senior years.

Second, seasonal differences in DEP and bootcamp attrition of NF recruits are completely explained by differences in the amount of time spent in the Delayed Entry Program. Therefore, level-loading accessions will increase attrition if the Navy increases the amount of time recruits expect to spend in the DEP. Since high school seniors are most responsive to changes in enlistment bonuses, an increase in DEP attrition seems likely. The total impact on attrition depends on the number of people the Navy convinces to extend their time spent in the DEP. Any increase in attrition will increase the Navy's recruiting costs as it replaces those who attrite.

The data do not suggest that recruit quality in the Nuclear Field has suffered in response to the level-loading of accessions. However, it is

important to emphasize that NF recruits are very different from the general population of Navy accessions. The lowest quality NF recruits are *not* low-quality; in any other rating, they would be considered high-quality recruits. Consequently, we recommend that recruit quality in other ratings be closely monitored if the Navy chooses to experiment with level-loading accessions in those ratings.

Finally, economic conditions have a very small effect on the ability of the Navy to level-load accessions. For modest changes in economic conditions, it does not appear that the effect is significant enough to outweigh any benefits of level-loading. In fact, relatively small changes in enlistment bonuses can offset any deleterious effects of a strong civilian economy. Changes in economic conditions between the time one enters the DEP and the time one enters bootcamp, however, do have a significant impact on DEP attrition.

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